

**BY ORDER OF THE COMMANDER
AIR FORCE MATERIEL COMMAND**

AFMC INSTRUCTION 21-138

23 DECEMBER 2004



Maintenance

***DEPOT MAINTENANCE MANAGEMENT FOR
FLIGHT TEST OPERATIONS***

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction establishes the minimum requirements and criteria for maintenance activities and scheduling during Functional Check Flight Operations at the Air Logistics Centers (ALCs), Aerospace Maintenance and Regeneration Center (AMARC), and contractor/contracted depot maintenance/aircraft modification services attached to an AFMC depot. It implements AFPD 21-1, *Managing Aerospace Equipment Maintenance*, AFI 21-102, *Depot Maintenance Management*, and AFMCPD 21-1, *Depot Maintenance Policy*.

Chapter 1

INTRODUCTION

1.1. General Information. FCFs are performed to ensure aircraft are airworthy and capable of mission accomplishment. The overall risk assessment level for the flight activity of FCF operations does not rise above “low” but it does result in an “elevated” risk due to the scope of maintenance. It is essential that functional check maintenance operations and check flight results are accurately documented and communicated between affected organizations within the centers. Strict maintenance discipline, accurate documentation, and trend analysis of FCF operations will contribute to mitigated risk, reduced cost, and maintaining maximum aircraft availability. ALCs, AMARC, and contractor/contracted depot maintenance/aircraft modification services attached to an AFMC depot will establish an efficient and effective maintenance FCF (trend analysis, documentation) program that meets the minimum requirements of this instruction and other applicable directives.

1.1.1. HQ AFMC/LGD is the OPR for this instruction. It provides basic requirements for the program and should be expanded as necessary to implement and maintain center programs. ALC and AMARC MAs are responsible for ensuring timely implementation of the requirements of this instruction and will appoint a center OPR. Local directives will be developed or updated for implementation within 180 days from the publication of this document and any subsequent change.

1.2. Procedures for Waiver Requests and Proposed Changes to this Instruction. Waivers to the policy requirements of this instruction must be processed using the procedures contained in AFI 33-360V1, *Publications Management Program*. Waiver requests will be staffed through the center OPR for signature by the Center MA. Waiver requests or proposed changes will be sent to HQ AFMC/LGD for action. Requests for waivers will also contain justification as to why the unit cannot comply with existing guidance. Deviations including “test” or “trial” programs are not authorized without prior HQ AFMC/LG written approval.

1.3. Maintenance Discipline. Maintenance discipline involves integrity in all aspects of the maintenance process. It is the responsibility of all maintenance personnel to comply with all written guidance to ensure all maintenance actions and documentation are completed in a safe, timely, and effective manner. Supervisors are responsible for establishing a climate that promotes maintenance discipline.

1.4. Operational Safety, Suitability, and Effectiveness (OSS&E). AFPD 63-12 and AFI 63-1202 assign the Single Manager (SM) the responsibility of assuring and preserving the OSS&E of the systems and end-items they manage. Changes to the configuration of or the maintenance procedures for the system or end item require the prior approval of the system manager.

Chapter 2

RESPONSIBILITIES

2.1. Responsibilities List.

2.1.1. Center CC. Center Commanders are responsible for establishing a close working relationship with Center MA and the Director of Flying Operations to ensure an understanding of the requirements and capabilities of maintenance actions. Center Directors will communicate and cooperate to enhance the center's capability to produce quality aircraft.

2.1.2. Air Crew Flight Operations.

- Director of Flying Operations (DFO). The designated rated officer responsible for oversight of day-to-day flight operations per AFI 11-401 AFMCS1, *Flight Management*.

- Operations Officer. The designated officer responsible for authorization, training, qualification, and currency of aircrew in the flying unit.

- Aircraft Commander. The designated individual responsible for the specific flight operations and execution of assigned FCF missions that have been authorized.

2.1.3. Center MA is responsible for compliance with this instruction, ensuring accurate FCF maintenance data collection, FCF trend analysis, and FCF reporting. MA or designated rep will ensure appropriate actions are taken to correct root cause of maintenance drivers/trends and reviewing all Post Dock unpredictable discrepancies to identify preventable defects (e.g. workmanship, training, documentation, etc...).

2.1.4. Center EN or equivalent (e.g. SPO engineer) will assist MA in reviewing Post Dock discrepancy reports as required. Provide technical expertise to assist in trend and root cause analysis as required.

2.1.5. HQ AFMC/LG. Director of Logistics is responsible for providing overall maintenance program policy and guidance.

2.1.6. HQ AFMC/EN. Provide technical/quality assurance expertise to assist HQ AFMC/LG in cross command trend analysis as requested.

2.1.7. HQ AFMC/SE. Director of Safety is responsible for oversight of reporting and investigating U.S. Air Force mishaps IAW AFI 91-204, *Safety Investigations and Reports*.

2.1.8. HQ AFMC/DO. Director of Operations is responsible for establishing policy and procedures that include flight operations for FCF operations.

Chapter 3

MAINTENANCE DISCREPANCY

3.1. Maintenance Discrepancy Data Collection. For the purpose of trend analysis all discrepancies discovered during Post Dock operations, including AFTO 781A entries, will be input into applicable management information system (e.g. PDMSS, MAXIMO). Weapon System Support Center (WSSC) or designated personnel will ensure that discrepancies and the corrective actions are entered into applicable management information system. Maintenance actions recorded in AFTO Form 781 series will be in accordance with T.O. 00-20-1.

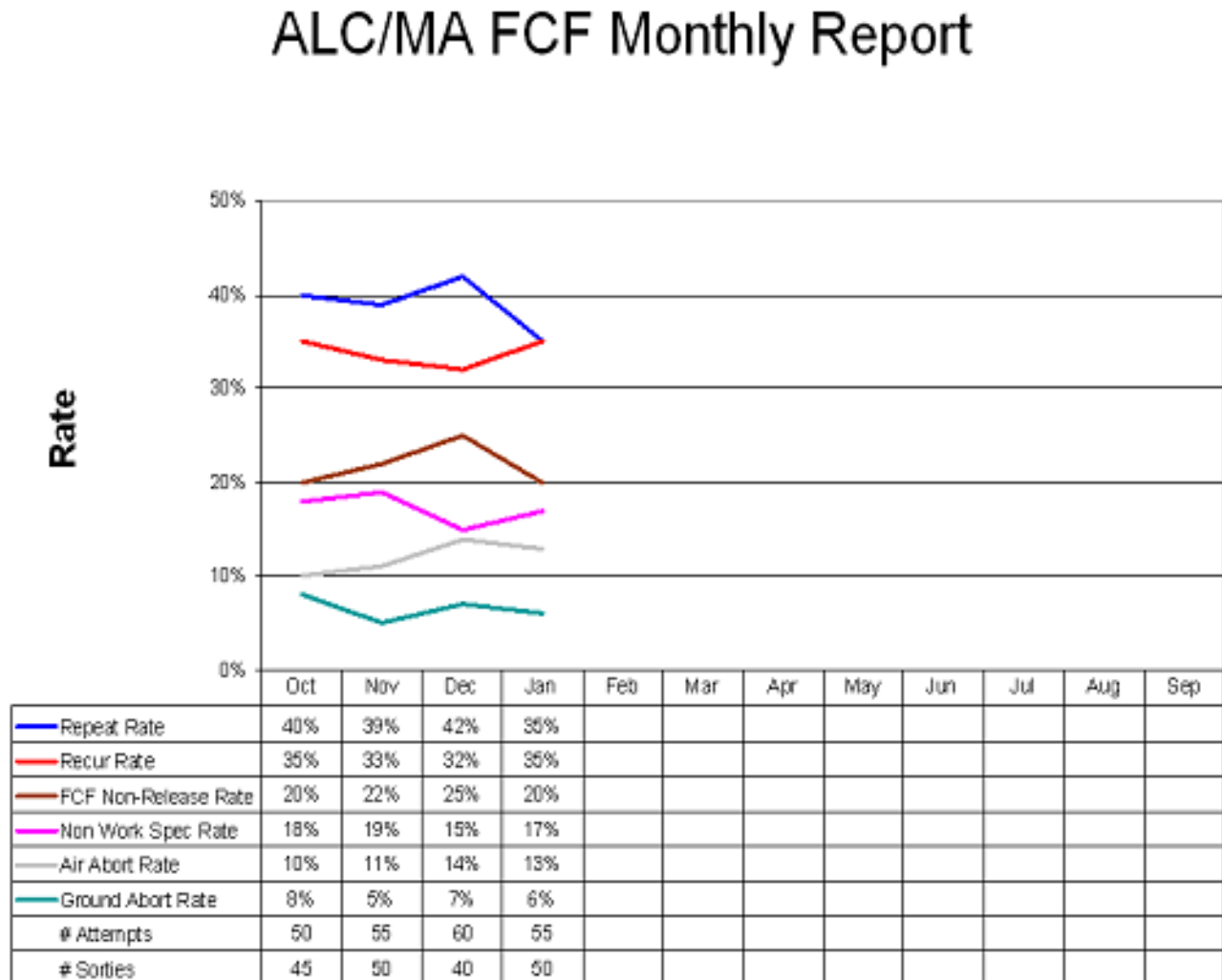
3.1.1. WSSC or designated personnel will collect the following data:

- Number of FCF flights per aircraft.
- Number of aircraft released.
- Number of FCF attempts. An FCF attempt is when an Exceptional Release is signed and the AFTO Forms 781 are presented to the crew.
- Unpredictable discrepancies found once aircraft has entered post dock area to include the following information:
 - Work Unit Code
 - When Discovered Code
 - How Malfunction Code

3.1.2. Production divisions will analyze, develop charts, and brief the following indicators to MA or designated representative monthly:

3.1.2.1. An overall monthly chart with the following indicators, Repeat Rate, Recur Rate, FCF Non-Release Rate, Non Work Spec Rate, Air Abort Rate (identify In Flight Emergencies), and Ground Abort Rate.

Figure 3.1. ALC/MA FCF Monthly Report.



3.1.2.1.1. Repeat Rate. This is a percentage of Aircrew Reported Discrepancies (ARD) that were repeats. A repeat discrepancy is one which occurs on the next sortie or attempted sortie after corrective action has been taken and the system or subsystem is used and indicates the same malfunction.

3.1.2.1.2. Repeat Rate = TOTAL REPEATS / TOTAL ARD.

3.1.2.1.3. Recur Rate. This rate indicates the percentage of ARDs that were recurs. A recurring discrepancy on an aircraft occurs on the second through the final releasing sortie or attempted sortie after corrective action has been taken and the system or subsystem is used and indicates the same malfunction.

3.1.2.1.4. Recur Rate = TOTAL RECURS / TOTAL ARD

3.1.2.1.5. FCF Non-Release Rate. This rate indicates the percentage of FCF attempts that resulted in a non-release.

3.1.2.1.6. FCF Non-Release Rate = TOTAL NUMBER OF NON-RELEASE ATTEMPTS / TOTAL NUMBER OF ATTEMPTS.

3.1.2.1.7. Non Work Spec Rate. This rate indicates the percentage of Post Dock discrepancies that are non work spec discrepancies. Non work spec discrepancies are discrepancies found in systems undisturbed by depot maintenance or aircraft modification.

3.1.2.1.8. Non Work Spec Rate = TOTAL NUMBER OF NON WORK SPEC DISCREPANCIES / TOTAL NUMBER OF POST DOCK DISCREPANCIES.

3.1.2.1.9. Air Abort Rate. This rate indicates the percentage of FCF sorties that result in an Air Abort. Identify Air Aborts that are declared In-Flight Emergencies.

3.1.2.1.10. Air Abort Rate = TOTAL NUMBER OF AIR ABORTS / TOTAL NUMBER OF SORTIES FLOWN.

3.1.2.1.11. Ground Abort Rate. This rate indicates the percentage of FCF attempts that resulted in a Ground Abort.

3.1.2.1.12. Ground Abort Rate = TOTAL NUMBER OF GROUND ABORTS / TOTAL NUMBER OF FCF ATTEMPTS.

3.1.2.2. A further breakout of leading indicators using Work Unit Code:

Figure 3.2. Leading Indicators Using Work Unit Code.

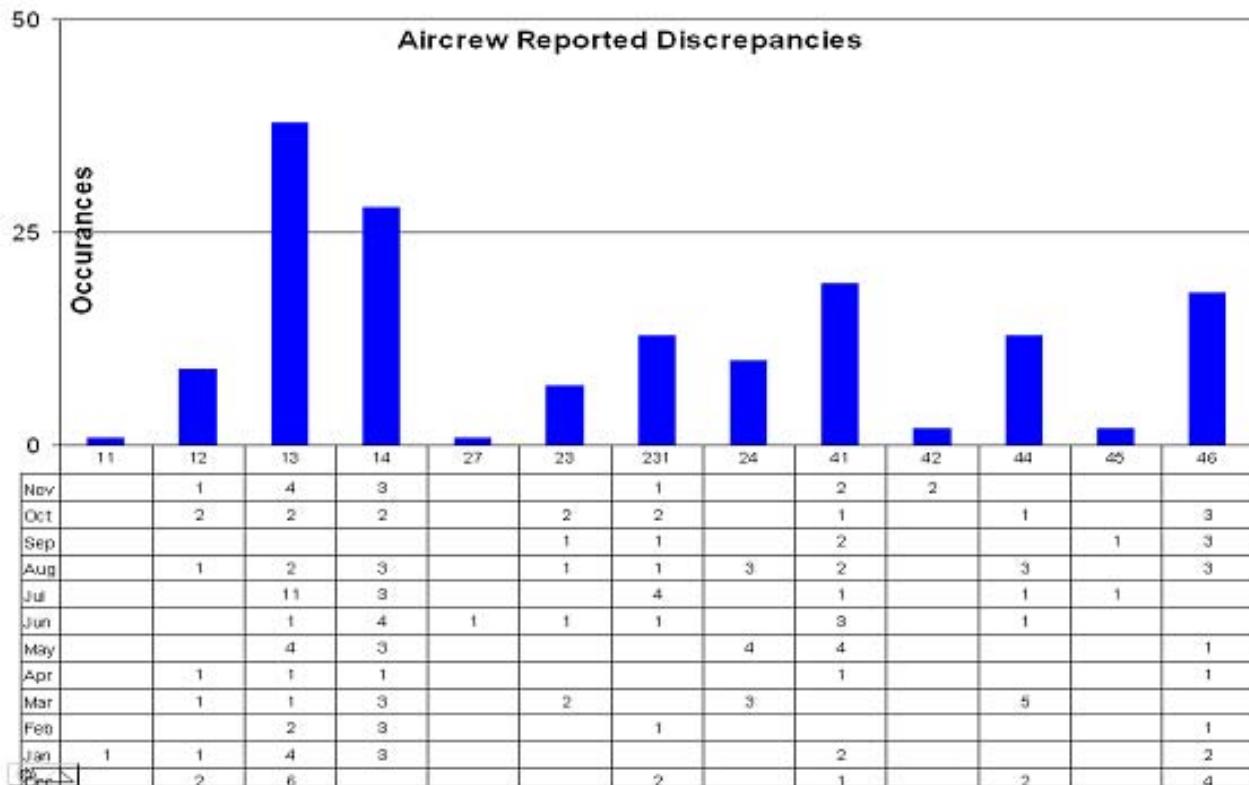
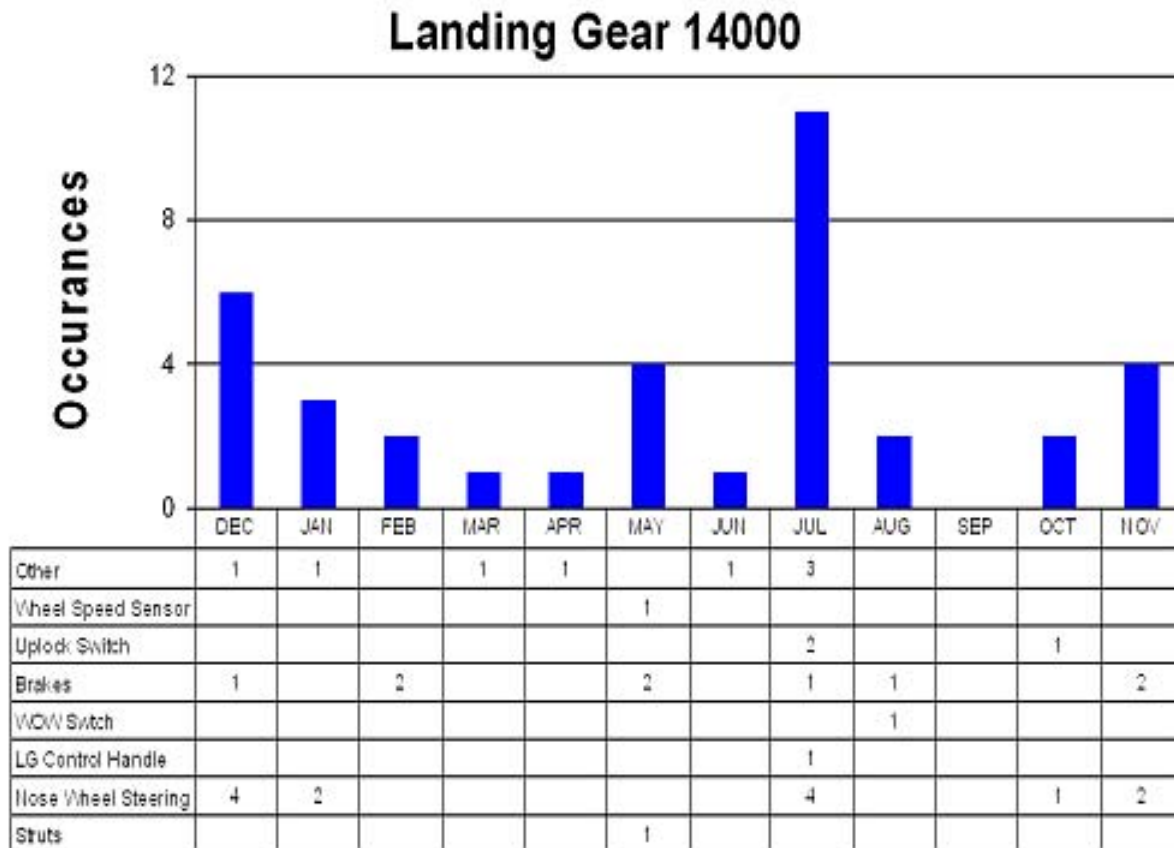


Figure 3.3. Single Aircraft System.



3.1.3. FCF Reporting Requirements. Center MA will report the following data to HQ AFMC/LGDA in the weekly report MTC-LG (W) 0401:

- Number of FCF sorties per aircraft tail number (organic and contract).
- Identify Air Aborts and IFEs.
- Number of FCF attempts per aircraft tail number (organic and contract).
- Total FCF attempts equals total FCF sorties plus Ground Aborts.
- Number of aircraft released per weapon system (organic and contract).

3.1.3.1. The following rates will be calculated by HQ AFMC/LG using the numbers reported above

- FCF Fly Rate. This rate indicates the average number of FCF sorties by MDS required to release the aircraft.

- FCF Attempt Rate. This rate indicates the average number of FCF attempts by MDS required to release the aircraft.

- FCF Effectiveness Rate. The rate indicates the percentage of aircraft that complete the FCF at or below the established fly rate standard for each weapon system.

3.1.4. Command Standards. Each calendar month, centers are measured with the FCF fly rate, FCF attempt rate, and FCF effectiveness.

3.1.4.1. FCF fly rate: Standard rates are statistically determined by calculating a 3-year look-back average. This standard will be used to assess monthly Fly rate performance.

3.1.4.2. FCF attempt rate: Standard rates will be computed in a similar manner as fly rates and will be used to assess monthly FCF attempt rate performance.

3.1.4.3. FCF effectiveness rate: The command standard will be established yearly by AFMC/LG, with AFMC/CC coordination, and will be used to assess monthly FCF effectiveness performance.

3.1.4.4. Modification of standards: Each of the standards will be reviewed on an annual basis to review validity of the current standards. Three-year look-back averages will be submitted to AFMC/LG NLT 1 Sep of each year by ALC/CCs. The data will be reviewed and compiled to publish the subsequent year standards by 1 Oct of each year.

Chapter 4

MAINTENANCE BRIEF

4.1. Maintenance Pre-Flight Brief. Each center will develop local procedures to ensure the FCF crew is aware of inbound discrepancies, work accomplished during Programmed Depot Maintenance (PDM), aircraft modifications, Time Compliance Technical Orders (TCTOs), discrepancies recorded on the aircraft or engines related to the FCF, engineering disposition requests (AFTO Form 202 or equivalent) and weight and balance documentation.

4.2. Maintenance Debrief. Responsible for overall management, collection, and control of ARD discovered during FCF operations. Debriefing personnel will be familiar with the weapon system and its general operation. Debriefing personnel validate ARDs, Aircraft Landing Status Codes, assign When Discovered Codes, How Malfunction Codes, Work Unit Codes, and identify repeat/recurring maintenance actions.

4.2.1. Debriefing is conducted at the termination of each flight or flight attempt.

4.2.2. Debriefing Area. Determined by the unit and is dictated by weapon system complexity. Minimize noise levels to permit effective communication.

4.2.3. Required Attendance. Maintenance functional supervisor, aircrew, Aircraft Logistics Specialist (ALS), and applicable specialists as determined by nature of discrepancy.

4.2.4. Documentation. WSSC or designated personnel will ensure discrepancies for each FCF are entered into the management information system and ensure discrepancies that result in aborts, IFEs, and repeat/recurs are identified.

4.2.5. Landing Status Codes.

4.2.5.1. FCF landing codes used for Functional Check Flights.

4.2.5.1.1. Release. Aircraft released for flight: may include discrepancies carried forward to home station.

4.2.5.1.2. Non-Release. Additional flight required after corrective action

4.2.5.1.3. Conditional Release. Additional flight may or may not be required pending aircraft commander's review of corrective action.

4.2.5.2. Additional flight landing codes: used for flights such as confidence, proficiency or delivery after aircraft has successfully completed FCF.

4.2.5.2.1. Code 1. Aircraft completed flight with no discrepancies.

4.2.5.2.2. Code 2. Aircraft or system has minor discrepancies but is capable of flight.

4.2.5.2.3. Code 3. Aircraft or system has major discrepancies in mission essential equipment.

Chapter 5

REPEAT/RECUR DISCREPANCIES

5.1. Response to Repeat/Recur Discrepancies. After the first repeat/recur of a non-release discrepancy discovered during an FCF attempt or flight, personnel from SPO engineering, Quality Assurance, and/or Technical Representatives will be consulted for troubleshooting assistance. Aircraft will be impounded after the 2nd repeat/recur of a safety-of-flight maintenance discrepancy, or a combination of both IAW AFMCI 21-139, *Depot Maintenance Impoundment Procedures*. The Impoundment Authority may impound the aircraft at anytime prior to the 2nd repeat/recur.

Chapter 6

SCHEDULING

6.1. Scheduling Procedures:

6.1.1. Annual Schedule. MA or designated representative in conjunction with the local Flight Test organization will develop the annual long range forecast of all depot activities to include scheduled and unscheduled depot maintenance, modification programs, and changing priorities NLT 1 Oct.

6.1.2. Quarterly Schedule. MA or designated representative in conjunction with the local Flight Test organization will provide a monthly rolling one quarter forecast of all depot activities to include scheduled and unscheduled depot maintenance, modification programs, and changing priorities. Emphasis will be placed on the next thirty day outlook.

6.1.2.1. This forecast will be used to enable flying units to schedule long lead time activities such as annual leave, TR manning, simulators, and other flight related training items.

6.1.3. Weekly schedule. NLT Thursday prior to execution week, MA will provide the projected flight schedule for all required FCF's and pick-up/delivery missions. Flight Test organization schedulers will add in any required ground or flight training events. The schedule will be finalized for publication NLT 1200 Friday prior to execution. Missions should be assigned a projected takeoff time based on AM/PM forecasts. For each initial FCF, also schedule subsequent re-fly's based on reported historical averages and required maintenance intervals. If the FCF is complete in less than the historical average, the remaining FCF sorties will be cancelled without penalty.

6.1.4. Daily schedule: The daily flight schedule will be coordinated each day between Production and Operations.

6.1.4.1. Mission ADDS. A mission may be added to the flight schedule with coordination and concurrence of both maintenance and flight operations. Missions that are not mutually accepted will not be counted in overall effectiveness assessments. Once an ADD is accepted, results (aborts, etc) will be computed as part of the effectiveness assessment.

6.1.4.2. Substitutions. Similar aircraft and sortie types may be substituted without any effectiveness penalty. If the mission or aircraft type is different, it will be treated as a schedule ADD and para 6.1.4.1. applies.

6.1.5. Scheduling Effectiveness. For internal tracking purposes, the centers will report deviations from the weekly schedule during the MA monthly meeting in the following areas:

6.1.5.1. Maintenance Cancel (MNX): The aircraft ER was not signed and the aircraft AFTO Forms 781 were not presented to the aircrew within the scheduled time (AM/PM). AM sorties may be ADDED to the afternoon schedule per para 6.1.4.1. PM sorties that can not be completed within Crew Duty Day (CDD)/daylight restrictions will be logged as MX CNX. A delay can be used in lieu of canceling the mission. If a delay extends beyond the point of being able to complete the FCF within CDD/daylight restrictions, the appropriate cancel will be logged against the originally scheduled sortie.

6.1.5.2. Operations Cancel (OPX). The aircraft is ready (ER and AFTO 781 complete) but an aircrew is not available during the scheduled window (AM/PM).

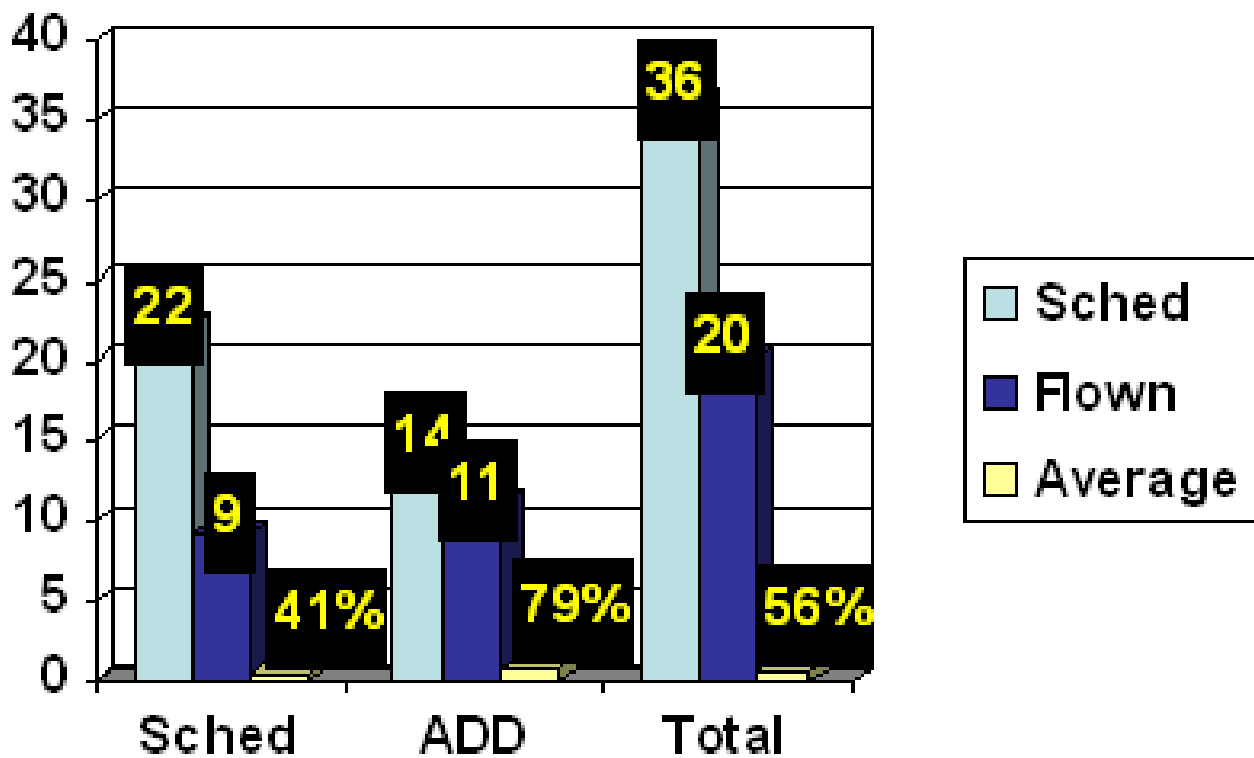
6.1.5.3. Weather Cancel (WTX). The aircraft is not flown during the scheduled window (AM/PM) due to actual or forecast weather conditions that are below published minimums.

6.1.5.4. Supply Cancel (SPX). The aircraft ER was not signed and the aircraft AFTO Forms 781 were not presented to the aircrew within the scheduled time (AM/PM) due to availability of parts and or POL.

6.1.5.5. Other Cancel (OTX). Any other circumstance preventing the aircraft from executing the scheduled event during the planned window (AM/PM). Examples are ATC, range closure, runway closure, etc.

6.1.6. Scheduling metrics. Units will track scheduling effectiveness metrics by MDS. If the aircraft is presented to the crew within the scheduled window (AM/PM), it is an effective event. The outcome of that event (ground abort, or flight) is evaluated in other areas. Overall scheduling efficiency is the ratio of effective events divided by scheduled events. Total events scheduled equals scheduled events (weekly and daily) plus ADDs.

Figure 6.1. Single Aircraft System.



6.1.6.1. The SCHED column is the effectiveness of weekly scheduled events. The ADD column tracks the effectiveness of schedule events added during the daily meetings. Total column is the aggregate scheduling effectiveness which includes the weekly scheduled events plus daily ADDs. Each set of columns includes the scheduled events and the actual delivered events.

6.1.6.2. Scheduling effectiveness rate command standard: The command standard will be established yearly and will be used to assess weekly scheduling effectiveness performance. The data will be reviewed and compiled to publish the subsequent year standards by 1 Oct of each year.

6.1.6.3. Reporting: Data will be provided to HQ AFMC/LGDI NLT the 15th of each month for the previous calendar month and will be used to prepare the above metric. This metric will be presented to HQ AFMC/LG.

Chapter 7

INCIDENTS

7.1. Reportable Incidents. Procedures for reporting or investigating all US Air Force mishaps will be IAW AFI 91-204, *Safety Investigations and Reports*.

DEBRA K. WALKER, Deputy Director for Maintenance
Directorate of Logistics and Sustainment

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFI 11-2FT, Volume 3, *Flight Test Operations Procedures*
AFI 11-202, Volume 3, *General Flight Rules*
AFI 11-401, *Flight Management*
AFI 21-102, *Depot Maintenance Management*
AFI 91-204, *Safety Investigations and Reports*
AFPD 21-1, *Managing Aerospace Equipment Maintenance*
AFMCI 21-110, *Depot Maintenance Technical Data and Work Control Documents*
AFMCI 21-115, *Depot Maintenance Quality Assurance*
AFMCI 21-133, *Depot Maintenance Management for Aircraft Repair*
AFMCPD 21-1, *Depot Maintenance Policy*
TO 00-20-01, *Aerospace Equipment Maintenance General Policy and Procedures*
TO 1-1-300, *Acceptance/Functional Check Flight and Maintenance Operational Checks*
TO 1-1B-50, *Basic Technical Order for USAF Aircraft Weight and Balance*
TO 1X-XX-6CF-1, for all applicable aircraft
TO 1X-XX-1, *Flight Manual for all applicable aircraft*

Abbreviations and Acronyms

A/C—Aircraft
ARD—Aircrew Reported Discrepancy
ALC—Air Logistics Center
ALS—Aircraft Logistics Specialist
AMARC—Aerospace Maintenance and Regeneration Center
IFE—In Flight Emergency
MRRB—Maintenance Requirements Review Board
PDM—Programmed Depot Maintenance
PDMSS—Programmed Depot Maintenance Scheduling System, G097
WCD—Work Control Document (usually AFMC 173)
WSSC—Weapon System Support Center
WUC—Work Unit Code

Terms

Air Abort—An air abort is an event where identified discrepancies prevent continuation of the planned profile, resulting in an early termination of the flight.

Aircraft Impoundment—Isolation of an aircraft due to an unknown malfunction or condition making it unsafe for flight.

Crew Ready—The aircraft is considered crew ready when the AFTO 781 series are complete with the exceptional release (ER) signed.

Debriefing—Program designed to ensure malfunctions identified by aircrews are properly reported and documented.

FCF Attempt—A functional check flight attempt begins once an aircraft is Crew Ready and the AFTO 781 series are presented to the crew.

FCF Sortie—A functional check flight by one aircraft. A sortie begins when an aircraft begins to move forward on takeoff. It ends after airborne flight when the aircraft returns to the surface and: Engines are stopped, or the aircraft is on the surface for 5 minutes, whichever occurs first.

Functional Check Flight (FCF)—FCFs are performed to determine whether an aircraft and its various components are functioning according to predetermined specifications while subjected to the flight environment. Any flight performed to accept or check accomplishment of depot maintenance, contract maintenance or modification will be identified as an FCF.

Ground Abort—A ground abort is an event after the FCF attempt is initiated that prevents the aircraft from becoming airborne within the published crew duty day, within daylight limitations, or within the scheduled window (AM/PM).

In-flight Emergency (IFE)—An IFE is an event where a significant identified discrepancy requires an immediate return to land. An IFE will not be double logged as an air abort.

Recurring Discrepancy—A recurring discrepancy is one that is not consecutive but occurs on the second through the final releasing sortie or attempted sortie after corrective action has been taken and the system or sub-system indicates the same malfunction when operated.

Repeat Discrepancy—One which occurs on the next sortie or attempted sortie after corrective action has been taken and the system or sub-system indicates the same malfunction when operated.

Maximo—Programmed Depot Maintenance Scheduling System used at AMARC.

Mission Design Series (MDS)—Alpha and numeric characters denoting primary mission and model of a military weapons system.

Weight and Balance (W&B) Program—Program used in calculating, verifying, updating, and computing weight and balance on a weapon system.